

# Outbreak Investigations

The purpose of this chapter is to provide general guidance for outbreak investigations. For disease-specific guidance, consult disease-specific guide to surveillance and investigations (GSI) chapters, subject matter experts, and/or regional support staff.

## PROTOCOL CHECKLIST

- ☐ Prepare for the outbreak investigation (including communication strategies) ([see page 2](#))
- ☐ Verify the diagnosis ([see page 2](#))
- ☐ Establish the existence of an outbreak ([see page 3](#))
- ☐ Define and identify cases ([see page 4](#))
  - ☐ Prepare a working case definition
  - ☐ Establish a data management system and common terminology
  - ☐ Identify additional cases
- ☐ Implement control and prevention measures ([see page 6](#))
- ☐ Describe the outbreak ([see page 7](#))
  - ☐ Prepare an EpiCom
- ☐ Develop hypotheses ([see page 7](#))
- ☐ Evaluate and refine hypotheses ([see page 8](#))
- ☐ Evaluate and refine control and prevention measures ([see page 8](#))
- ☐ Communicate findings throughout ([see page 9](#))

# Outbreak Investigations

## 1. PREPARE FOR THE OUTBREAK INVESTIGATION

### A. Identify staff resources

- Know your local staff resources:
  - Primary epidemiologic contact
  - Medical staff available for consultation
  - Staff members capable of performing clinical testing and/or specimen collection
  - Staff member capable of conducting field interviews
  - Staff members capable of data management/analysis
  - IT staff for technological support
  - Environmental health staff to conduct environmental assessments
  - Staff member(s) responsible for communication
- Know your support staff resources:
  - Subject matter expert for the diseases
  - Your [Regional Epidemiologist–Laboratory Liaison](#)
  - Your [Regional Environmental Epidemiologist](#)
  - Other
    - These may include consortium epidemiologist, epidemiology strike teams, and any other work-related organizations or any memorandum of understanding (MOU) for your region. Outbreaks may require assistance from outside organizations and agencies, such as Florida Department of Agriculture and Consumer Services, Centers for Disease Control and Prevention (CDC), health care providers, infection control prevention practitioners or Florida Poison Information Center Network.

### B. Familiarize yourself with outbreak resources

- Read disease-specific GSI chapters.
- Train and practice with outbreak data management software (e.g., Epi Info™).
- Read *Field Epidemiology* by Michael B. Gregg.
- Have the *Control of Communicable Diseases Manual (CCDM)* and *Red Book* available for reference.

## 2. VERIFY THE DIAGNOSIS

### A. Contact the reporting provider

- Obtain clinical information.
- Ensure the reported condition is clinically compatible.
- If you are unsure about the diagnosis, contact your support staff.

### B. Review any laboratory results

- Make sure the results are appropriate for reported condition.
- Ensure that the result is not due to a laboratory or interpretation error.
- Forward the specimen to the Bureau of Public Health Laboratories (BPHL) for confirmation when appropriate.

- Contact your support staff if you are unsure about the laboratory results, or whether to submit specimens.

### 3. ESTABLISH THE EXISTENCE OF AN OUTBREAK

#### A. Determine if observed number of cases exceeds the expected baseline

- Establish an expected baseline. This can be done through numerous methods depending on the type of the disease. Some examples include:
  - Data analysis in Merlin; look for geographic or seasonal patterns.
  - Review the number of cases reported in the Florida annual *Morbidity Statistics Report* over a similar timeframe.
  - Use ESSENCE-FL to identify similar discharge diagnoses.
  - Query the health care system's health record for similar cases.
  - Review facility infection control records.
  - Review scientific literature.
  - Conduct a survey of people in the targeted community.
- For certain reportable conditions, an outbreak can consist of two or more individuals (or households) with reported similar signs, symptoms, and exposure settings. Single cases of certain diseases or conditions are investigated similarly to outbreaks.
- Collect additional specimens from those who are symptomatic to verify the existence of an outbreak and submit to BPHL for confirmation.
  - Clinical lab submission form for the BPHL:  
[http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/surveillance-and-investigation-guidance/\\_documents/dh1847clinicallabsubmissionform.pdf](http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/surveillance-and-investigation-guidance/_documents/dh1847clinicallabsubmissionform.pdf)
  - Packaging and shipping of specimen flowchart:  
[http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/surveillance-and-investigation-guidance/\\_documents/packagingflowchar0422051.pdf](http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/surveillance-and-investigation-guidance/_documents/packagingflowchar0422051.pdf)
- If you are unsure if the number of cases exceeds the baseline, contact your support staff and they can assist in developing methods for verifying the existence of an outbreak.

#### B. If the existence of an outbreak is established:

- Notify your supervisor.
- Determine with your supervisor and potentially your support staff if an incident management team (IMT) is needed, possibly including an incident commander.
- Determine if personnel must function outside of normal duties. Personnel should request permission from their supervisor to participate in outbreak activities outside of their daily responsibilities.
- Notify your appropriate support staff.
- Prepare an EpiCom as early as possible with preliminary information, which should be updated as the investigation progresses.

**4. DEFINE AND IDENTIFY CASES****A. Create a working case definition**

- Case definitions can be modified as the outbreak investigation evolves.
  - Early in investigations, a loose case definition can be beneficial in understanding the scope of the outbreak and can subsequently be tightened to be more specific.
- All case definitions should include person, place and time.
  - Defining a person:
    - This should include clinical information about the disease, laboratory results, or characteristics about the people who are affected.
    - Examples may include: pregnant women diagnosed with influenza, children with a positive polymerase chain reaction (PCR) laboratory result for pertussis, or individuals with diarrhea, vomiting, or abdominal cramps in the preceding 72 hours.
  - Defining a place or setting:
    - This should be broad enough to include most cases that have a setting in common, but specific enough to minimize the number of individuals who may “falsely” meet the case definition.
    - Examples may include: at hospital A, at local elementary school B, in County C, or who ate at the Doe’s wedding rehearsal dinner.
  - Defining time:
    - This should give an idea as to when the outbreak occurred and be specific enough to replicate any search queries or investigation, including dates and years when possible.
    - Examples may include: in 2014, from March 26 through May 19 2014, after June 29 2013.
  - Examples:
    - Students with pertussis-like symptoms for greater than two weeks who attended School A in XXX County between January 1 2014 and February 1 2014.
    - Individuals with eye pain, corneal abrasions, or conjunctivitis following attendance at a foam party at Club A on March 26, 2014.
- Once a basic working case definition has been developed, different levels of the outbreak case definition can be established based on the certainty of a case being a “true case”. For reportable conditions, these criteria are in the reportable disease case definitions.
  - For example: confirmed cases (usually meet clinical case definition with laboratory confirmation or epidemiological links), probable cases (meeting the clinical case definition but lacking laboratory confirmation), and possible/suspect cases (individuals who need more investigation to determine if they meet the case definition but cannot at the time be ruled out as cases).

**B. Establish a data management system**

- Identify what data to collect and its purpose prior to conducting an outbreak investigation. These steps improve data quality and save time on analysis.
- Determine which software to use and its limitations prior to collecting data.
  - Review existing case report forms and any extended data screens in Merlin.

- Consider the need to create an incident-specific questionnaire or case report form.
- Determine if multiple data entry staff will be needed.
- Consider if data can be entered/collected remotely.
- Minimize redundancy in reporting into multiple data systems.
- Contact your support staff to assist in developing a data management system for the outbreak investigation.
- If investigating a reportable condition/disease, ensure that all persons meeting the Florida case definition are entered into Merlin.
  - Merlin is the official tool for all reported cases during the investigation; however, other data management tools may be more useful in contact tracking, form design, epidemiologic studies, data analysis, etc.

### **C. Establish common terminology**

- All individuals working together in the investigation should be utilizing common terminology for the investigation, and this is especially critical when multiple jurisdictions/agencies are involved in the investigation.
- Previous large-scale investigations have identified this need and some common terms identified are:
  - Number of persons exposed: The identified number of persons in the investigation that had contact/exposure to/with a person/vector/product that could have resulted in an illness.
  - Number of persons contacted: This is the number of exposed persons that public health resources have attempted to notify of the risk to their health from their contact/exposure during the course of the investigation.
  - Number of persons reached: The total number of persons that were contacted and were successfully given a public health notification as a result of the investigation.

### **D. Communication during an investigation**

- Communication between public health agencies during the investigation:
  - An official point of contact should be designated at the county and state level.
    - All contact between agencies should be through the official points of contact.
    - Direct contact outside of the established outbreak chain of command with deployed staff is discouraged.
    - All media inquiries should be handled by a specified point of contact designated by the Incident Commander or lead investigator in accordance with the communication strategy for the outbreak.
- Updates of findings should be communicated to the Incident Commander or official point of contact regularly.
  - Updates should occur no more frequently than once per day.
  - As the investigation progresses the frequency of regular updates with leadership should become less frequent.
  - For a non-communicable disease, consider a weekly reporting schedule, as this will allow for the validation of cases prior to reporting.
- Communication to exposed individuals during the investigation (if warranted):
  - Health care providers can be a valuable resource in contacting and notifying patients, especially during investigations involving exposures in a health care setting.

- When health care providers are unable or refuse to contact patients about exposures involving a health care setting, DOH is responsible for ensuring contact to exposed individuals.

**E. Identify additional cases**

- Determine which persons are at risk of becoming ill.
- Develop a surveillance strategy to identify additional cases.
- If applicable, collect additional laboratory samples/specimens.
- Exposed individuals determined to be at greatest risk of becoming ill or having the most adverse health outcomes should be prioritized for follow up.
  - Strategies for determining prioritization varies depending on the incident, but may include:
    - Amount of time individual was exposed
    - Number of exposures
    - Exposures to a specific lot/product/individual where previous transmission has occurred
    - When the exposure occurred
    - The presence of risk factors (i.e., pregnant women)
- Consider methods to identify additional cases based on the specific incident. Examples of methods to identify additional cases may include:
  - ESSENCE-FL search queries for chief complaints or discharge diagnoses
  - Medical record abstraction (remotely or in person)
  - Interviews of exposed individuals may include contact tracing, public outreach, and active surveillance
  - Randomized serosurveillance

**5. IMPLEMENT CONTROL AND PREVENTION MEASURES**

**A. NOTE: THIS SHOULD BE DONE AS SOON AS POSSIBLE**

- During most outbreaks, control measures can be identified early, prior to laboratory result confirmation or completion of epidemiologic data analysis.

**B. Ideally, use data driven measures aimed at limiting transmission or exposure in the:**

- Host
  - Cohorting
  - Isolating/quarantining
  - Vaccinations
  - Chemoprophylaxis
  - Behavioral modifications
- Agent
  - Antimicrobials
  - Vector reduction/removal
- Environment
  - Modifying air flow or limiting contact
  - Disinfection/sterilization of environment
  - Destruction of breeding sites or of contaminated foods/products
  - Vector reduction/removal

## 6. DESCRIBE THE OUTBREAK

### A. Orient the data in terms of person, place and time

- Person descriptive epidemiology (minimum):
  - Number ill
  - Number exposed
  - Attack rates
  - Descriptive characteristics of ill and exposed
    - Age
    - Race/Ethnicity
    - Gender
    - Other demographic risk factors
  - Severity of incident (number hospitalized, mortality)
  - Incident specific risk factors (i.e., vaccinated, foods eaten, lot number)
  - Symptomology
- Place descriptive epidemiology (minimum):
  - Number ill per setting
  - Number exposed per setting
  - Attack rate per setting
  - Incident specific settings (i.e., grade level, daycare, hospital floor, ZIP codes)
- Time descriptive epidemiology (minimum):
  - Epi curve of symptom onset
    - Plot the frequency of cases with onset on the y-axis and by the date (or other time period) their symptoms began on the x-axis
  - Epi curve of exposure to causative agent
    - Plot the frequency of cases with exposure on the y-axis and by the date their exposure occurred on the x-axis
  - Duration of illness
- If you have any questions on how or what to include in orienting the data, contact your support staff.

### B. Prepare an EpiCom for the outbreak (see guidance at:

[http://dohiws.doh.ad.state.fl.us/Divisions/Disease\\_Control/epi/EpiCom/epicom\\_post.pdf](http://dohiws.doh.ad.state.fl.us/Divisions/Disease_Control/epi/EpiCom/epicom_post.pdf))

- Items to include:
  - Person
  - Place
  - Time
  - Relevant exposures
  - Status of the investigation
  - Control measures

## 7. DEVELOP HYPOTHESES

### A. Generate examinable hypotheses that could explain how and why the outbreak occurred.

- **Generating hypotheses should be performed at various steps throughout the process to ensure testable hypothesis data is captured in steps 2-5 above.**
- Consider what you already know about the disease and its transmission.
- Identify any previously known risk factors by consulting the following resources:

- *Red Book, CCDM*
- Literature review
- Subject matter experts or regional support staff
- CDC, FDA, NIH websites
- Utilize open-ended and wide-ranging questions early on while verifying the diagnosis for common exposures or individual traits.
- Use descriptive epidemiology to generate hypotheses:
  - What is the epi curve suggesting and what events occurred around the exposure period?
  - Does a particular area, grade, or school have a higher attack rate?
  - Are persons of a different age, vaccine status, or sex at greater risk of illness?
- If you need assistance in generating hypotheses throughout the entire process of the investigation, contact your support staff.

## **8. EVALUATE AND REFINE HYPOTHESES**

### **A. Utilize analytic epidemiology to test your hypotheses**

- Determine which type of study your outbreak investigation fits (i.e., cohort, prevalence, case-control).
- Select appropriate statistical test methods for type of study.
- Contact your support staff if you are having challenges in analyzing your hypotheses.

### **B. Determine if your results are confounded by additional factors**

- Utilize analytical methods to control for confounding factors where appropriate.

### **C. Continue to develop and evaluate hypotheses**

- Compare and control for risk factors affecting outcomes of interest.
- Incorporate clinical and environmental samples as dictated by investigation.
- Modify questionnaire or survey instruments as needed.
- If previous hypotheses fail to yield results, the need to re-interview those infected or ask additional open-ended questions may be necessary.

## **9. EVALUATE CONTROL AND PREVENTION MEASURES**

### **A. Use results from hypotheses testing to initiate any additional control and prevention measures**

- If more infected persons continue to be identified following implementation of control and prevention measures:
  - Determine if additional control and prevention measures need to be implemented as driven by data analysis.
  - Determine if currently implemented control measures are having the desired impact in control and prevention of the disease/condition.

### **B. As investigation progresses, continue to assess if control and prevention measures are sufficient**



## 10. COMMUNICATE FINDINGS

### A. Report investigation findings to stakeholders

- Can be oral
  - Stakeholder meeting
  - Epidemiology Biweekly Conference Call
  - Bureau of Epidemiology Grand Rounds
- Can be written
  - EpiCom post
  - Stakeholder reports
  - *Epi Update* article
  - Peer-reviewed published manuscript

### B. Written reports should follow the scientific method including:

- Background/Introduction (What is already known? What started the Investigation?)
- Methods (What was done?)
- Results (What was the outcome? What was found?)
- Discussion and Recommendations (What was learned? What could be improved? What could prevent future incidents?)
- References (Where can others find useful information on this topic?)

### C. If assistance is needed in communicating findings, contact your support staff

## 11. IMPORTANT LINKS

### A. Surveillance and Investigation Guidance:

<http://www.floridahealth.gov/diseases-and-conditions/disease-reporting-and-management/disease-reporting-and-surveillance/surveillance-and-investigation-guidance/index.html>

### B. FOCUS on Field Epidemiology

<http://cphp.sph.unc.edu/focus/>

## 12. REFERENCES

- A. Heymann, D.L. (Ed.). (2008). *Control of Communicable Diseases Manual* (19<sup>th</sup> ed.). Washington: American Public Health Association.
- B. American Academy of Pediatrics. (2009). *Red Book: 2009 Report of the Committee on Infectious Diseases* (28<sup>th</sup> ed.). Grove Village, IL: American Academy of Pediatrics.
- C. Gregg M.B. (Ed.) (2002). *Field Epidemiology* (2<sup>nd</sup> ed.). New York: Oxford University Press.